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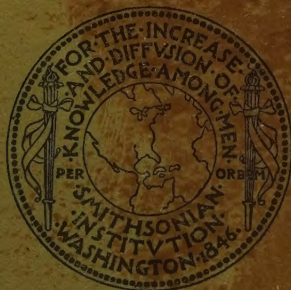
CONTRIBUTIONS TO THE BIOLOGY OF THE  
PHILIPPINE ARCHIPELAGO AND  
ADJACENT REGIONS

THE PHILIPPINE LAND MOLLUSKS  
COCHLOSTYLA RUFOGASTER AND  
OBBA MARMORATA AND THEIR  
RACES

BY

PAUL BARTSCH

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SMITHSONIAN INSTITUTION  
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# THE PHILIPPINE LAND MOLLUSKS COCHLOSTYLA RUFOGASTER AND OBBA MARMORATA AND THEIR RACES

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## COCHLOSTYLA RUFOGASTER AND ITS RACES

A sending of a lot of specimens of what is herein described as *Cochlostyla rufogaster juani*, by the Philippine Bureau of Science for determination, has made it necessary to subject the entire complex of *Cochlostyla rufogaster*, as well as some other species which have sometimes been designated under this name, to a critical review, the results of which are set forth in the following pages.

All the specimens mentioned as having been collected by me were obtained during the cruise of the United States Bureau of Fisheries steamer *Albatross* in the Philippine Archipelago, 1907 and 1908.

Lesson, in 1831, described, and figured on Plate 22 of his *Illustrations de Zoologie*, a shell in the collection of the Duke of Rivoli. The figure, I believe, is referable to the large conic race that inhabits the region about Mariveles, Bataan Province, Luzon. The shell figured is a dead decorticated specimen, the loss of whose epidermis exposed the red color of the later turns and the light peripheral zone. Lesson states that the habitat from which the specimen came was unknown.

*Cochlostyla rufogaster* as now conceived extends over central Luzon from Benguet south to Mount Banahao and Mount Maquiling. As is usual with Philippine land shells, we find that a certain degree of differentiation has taken place in the shells in the various habitats occupied, which makes it not only possible but desirable to recognize certain zoogeographic races and to designate these as subspecies, which is here done.

The races of *Cochlostyla rufogaster* vary from elongate-conic to ovate, from moderately slender to inflated. They range in height from more than 90 mm to less than 50 mm. In shells with perfect periostracum this is buff on the early whorls and wood brown on the



later, marked by retractively slanting zones of dark brown. These dark zones form a more or less fenestrated pattern occupying the region immediately below the suture. This character finds varying degrees of expression in the different subspecies. There is usually a light peripheral zone, which shows considerable variation in width in different shells and in some specimens appears almost completely if not quite suppressed. The periostracum is also marked by fine axial hair lines of varying shades of brown and numerous equally slender spiral lines on spire and base. Decorticated specimens show the early whorls flesh colored, the succeeding turn or two of buffish tinge, followed by reddish-orange to chestnut-brown tints. The peristome is dark; the columella white tinged with brown, while the parietal callus usually agrees with the interior of the aperture in color, varying from bluish white to pale slate-blue.

**COCHLOSTYLA RUFOGASTER BENGUETANA, new subspecies**

PLATE 83, FIGURE 2

1891. *Cochlostyla rufogaster* HIDALGO, Obras Malacologicas, p. 373, in part.  
1898. *Cochlostyla rufogastra* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 138, in part.  
1912. *Cochlostyla rufogaster* MÖLLENDORFF, Kobelt and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pt. 14, p. 287, in part.

This northern mountain race is elongate-ovate, with the whorls rather inflated and rather strongly rounded at the summit. The periphery of the last whorl is well rounded, showing no trace of angulation. The unique type lacks the light peripheral zone. The interior is bluish pearl gray and the peristome pale chocolate-brown. In the inflation and rounding of the summit of the whorls it resembles *Cochlostyla rufogaster montalbana*, from which it is readily distinguished by its much narrower shape and lack of peripheral angulation.

*Type*.—U.S.N.M. No. 208212, from Trinidad, Benguet Province, Luzon. It has 6.1 whorls, and measures: Height, 76.2 mm; greater diameter, 50.7 mm.

*Remarks*.—The references cited above refer to members of this species in the general region from which the type came, and I believe belong to this subspecies.

**COCHLOSTYLA RUFOGASTER JUANI, new subspecies**

PLATE 85, FIGURE 1

Shell rather broadly ovate with the whorls somewhat inflated and rather well rounded, particularly so near the summit. The peripheral light zone is not overly strongly emphasized in the 15 shells be-

fore us. In seven of them there is not a trace of it, and none shows it when decorticated. The last whorl is very dark chestnut-brown, while the peristome and the major portion of the columella are almost black. The inside of the aperture is equally dark, bluish pearl gray—darker than those in any other race before us.

This race seems nearest to *Cochlostyla rufogaster rufogaster*, from which it is easily distinguished by its much darker coloration and the lack of the conspicuous peripheral band in the decorticated shell. The peripheral angle is also almost absent.

*Type*.—U.S.N.M. No. 313002, as well as all the specimens before us, was collected at Novaliches, northeast Rizal Province, Luzon. It has 5.9 whorls, and measures: Height, 64.3 mm; greater diameter, 48.1 mm.

*Remarks*.—The rest of these specimens yield the following data:

| Number of whorls | Height    | Greater diameter | Number of whorls | Height    | Greater diameter |
|------------------|-----------|------------------|------------------|-----------|------------------|
|                  | <i>Mm</i> | <i>Mm</i>        |                  | <i>Mm</i> | <i>Mm</i>        |
| 6.4-----         | 65.7      | 45.6             | 6.0-----         | 62.2      | 43.8             |
| 6.2-----         | 63.4      | 48.0             | 6.0-----         | 56.9      | 43.9             |
| 6.1-----         | 61.5      | 43.0             | 6.1-----         | 61.3      | 44.3             |
| 6.2-----         | 62.8      | 45.0             | 6.0-----         | 68.7      | 53.2             |
| 6.3-----         | 65.4      | 43.0             | 6.1-----         | 61.5      | 41.8             |
| 6.2-----         | 65.4      | 44.3             | 6.2-----         | 56.2      | 42.3             |
| 6.0-----         | 62.0      | 45.8             | 5.9-----         | 49.6      | 36.7             |

The last specimen was severely injured at an early stage and is decidedly dwarfed and abnormal.

Nine of these specimens were collected by F. Juan, for whom I have named the race; the rest were secured by A. Duyag.

**COCHLOSTYLA RUFOGASTER MONTALBANA, new subspecies**

PLATE 83, FIGURE 1

1846. *Bulimus rufogaster* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, 2d ed., vol. 1, Abth. 12, Theil 2, pp. 164–165, in part, pl. 50, fig. 21.  
 1850. *Bulimus rufogaster* REEVE, Conchologia Iconica, species 4, in part.  
 1851. *Bulimus rufogaster* DESHAYES, Ferussac's Histoire naturelle mollusques, vol. 1, p. 9, in part, pl. 116, figs. 3, 6.  
 1890. *Cochlostyla rufogaster* PILSERY, Man. Conch., ser. 2, vol. 6, p. 207, in part, pl. 43, fig. 26.  
 1891. *Cochlostyla rufogaster* HIDALGO, Obras Malacologicas, p. 373, in part, pl. 61, fig. 5?; pl. 105, fig. 5.

This race is rather large and broadly ovate. It has an obsolete peripheral angle, and a light zone may or may not be present at this place under the periostracum. It suggests most nearly *Cochlostyla*



*rufogaster manilana*, but differs from it in being broader and in having the whorls more inflated.

*Specimens examined*.—The type, U.S.N.M. No. 255859, was collected by me at Montalban, Rizal Province, Luzon. It has 6.1 whorls, and measures: Height, 75.2 mm; greater diameter, 52.3 mm. Another specimen, U.S.N.M. No. 256084, also collected by me at the type locality, has 6.1 whorls, and measures: Height, 69.3 mm; greater diameter, 53 mm. Two specimens from the type locality collected by LeRoy Topping also have each 6.1 whorls, and measure: Height, 71.8 and 70.8 mm; greater diameter, 53.2 and 52.8 mm, respectively. In addition to this there are a number of shells present that are not quite mature.

**COCHLOSTYLA RUFOGASTER ANTIPOLANA, new subspecies**

PLATE 85, FIGURE 2

1891. *Cochlostyla rufogaster* HIDALGO, Obras Malacologicas, pp. 372-374, in part.

Shell small, broadly ovate, obscurely angulated at the periphery. Peripheral light band narrow, bordered posteriorly by a dark zone. The light zone is scarcely indicated in decorticated specimens. Interior bluish pearly; peristome chocolate-brown; pillar axially mottled with brown.

*Specimens examined*.—The type, U.S.N.M. No. 240246, was collected by LeRoy Topping at Antipolo, Rizal Province, Luzon. It has 6.1 whorls, and measures: Height, 58.7 mm; greater diameter, 48.3 mm. U.S.N.M. No. 255985 contains two specimens collected by myself near the falls at Antipolo. These measure:

| Number of whorls | Height     | Greater diameter |
|------------------|------------|------------------|
| 6.1-----         | Mm<br>56.2 | Mm<br>39.2       |
| 5.6-----         | 51.5       | 41.6             |

In its small size this race approaches *Cochlostyla rufogaster monozona* Pfeiffer. It is, however, more broadly ovate and has the periphery much more strongly angulated.

**COCHLOSTYLA RUFOGASTER MONOZONA (Pfeiffer)**

PLATE 84, FIGURES 1, 2

1846. *Bulimus monozonus* PFEIFFER, Monographia heliceorum viventium, vol. 2, p. 533.

1848. *Bulimus monozonus* PFEIFFER, Proc. Zool. Soc. London, p. 110.



1850. *Bulimus monozonus* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, 2d ed., vol. 1, Abth. 12, Theil 2, 159, t. 46, figs. 7, 8.
1851. *Bulimus monozonus* REEVE, Conchologia Iconica, pl. 32, fig. 195.
1853. *Bulimus monozonus* PFEIFFER, Monographia heliceorum viventium, vol. 3, p. 296.
1858. *Bulimus monozonus* H. and A. ADAMS, Genera of recent Mollusca, vol. 2, p. 142.
1860. *Orthostylus monozona* MARTENS, Albers, Die Heliceen, 2d ed., p. 178.
1868. *Bulimus monozonus* PFEIFFER, Monographia heliceorum viventium, vol. 6, p. 6.
1868. *Cochlostyla monozonus* PFEIFFER, Monographia heliceorum viventium, vol. 6, p. 6.
1872. *Orthostyla monozonus* V. MARTENS, Malacozool. Blät., vol. 20, p. 178.
1874. *Cochlostyla monozona* SEMPER, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 205, in part.
1876. *Bulimus monozonus* PFEIFFER, Monographia heliceorum viventium, vol. 8, in part, p. 7.
1876. *Cochlostyla monozona* PFEIFFER, Monographia heliceorum viventium, vol. 8, in part, p. 7.
1887. *Cochlostyla rufogaster* HIDALGO, Journ. Conchyl., vol. 35, pp. 160-1, in part.
1890. *Cochlostyla rufogaster* PILSBRY, Man. Conch., ser. 2, vol. 6, pp. 207-8, in part, pl. 45, fig. 47.
1891. *Cochlostyla rufogaster* HIDALGO, Obras Malacologicas, pp. 372-4.
1894. *Helicostyla rufogastra monozonus* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 227.
1896. *Helicostyla rufogastra monozonus* ELERA, Catalogo sistematico de toda la fauna Filipinas, vol. 3, p. 593, in part.
1898. *Cochlostyla rufogastra* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 138, in part.
1912. *Cochlostyla rufogastra* MÖLLENDORFF, Kobelt and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pt. 14, p. 287.

This is the small race said to come from Manila. Our specimens show the pale yellow, rather broad peripheral zone when the periostracum is removed. The shell is much more oval than in *Cochlostyla rufogaster antipolana*, and the periphery of the last whorl has the merest indication of an angulation.

*Specimens examined.*—The specimen described and figured is one of two, U.S.N.M. No. 66178, collected by J. B. Steere at Manila. It has six whorls, and measures: Height, 49.2 mm; greater diameter, 35.3 mm. The other shell also has six whorls, and measures: Height, 48.2 mm; greater diameter, 37.7 mm. Two additional specimens collected by Febiger, U.S.N.M. No. 105247, also come from Manila. One of these is not quite adult. The adult shell has 5.9 whorls, and measures: Height, 47 mm; greater diameter, 34.2 mm.

U.S.N.M. No. 315681 contains a specimen from the Evezard collection, which belongs here. This has 5.7 whorls, and measures: Height, 52 mm; greater diameter, 39.3 mm.

## COCHLOSTYLA RUFOGASTER MANILANA, new subspecies

## PLATE 84, FIGURE 4

1867. *Cochlostyla rufogaster* MARTENS, Die preussische Expedition nach Ost-Asien, vol. 2, p. 92, in part.  
 1890. *Cochlostyla rufogaster* PILSBRY, Man. Conch., ser. 2, vol. 6, p. 207, in part, pl. 43, fig. 27.  
 1891. *Cochlostyla rufogaster* HIDALGO, Obras Malacologicas, p. 373, in part, pl. 61, fig. 4.  
 1896. *Orthostyla rufogaster* ELERA, Catalogo sistematico de toda la fauna Filipinas, p. 593, in part.

In this race the shell is elongate-ovate. The aperture is rather flaring and the periphery obtusely angulated. A light zone may or may not be present at the periphery when the periostracum is removed. The peristome is chocolate-brown. The shell differs from *Cochlostyla rufogaster monozona* in being much larger and in having the periphery angulated. It differs from *Cochlostyla rufogaster antipolana* and *Cochlostyla rufogaster montalbana* in being less broadly ovate.

I believe that this race will be found in most collections labeled *Cochlostyla rufogaster*.

*Specimens examined*.—The type, U.S.N.M. No. 310305, figured, is one of two collected by the Exploring Expedition at Manila. It has 6.3 whorls, and measures: Height, 69 mm; greater diameter, 47.5 mm. The other specimen, U.S.N.M. No. 7611, has 6.2 whorls, and measures: Height: 70.5 mm; greater diameter, 50.7 mm. There are 12 additional specimens in the collection, which undoubtedly belong here, received mostly from the old collectors and labeled Philippine Islands or Luzon. I am not giving measurements of these because specific locality data are missing.

## COCHLOSTYLA RUFOGASTER RUFOGASTER (Lesson)

## PLATE 83, FIGURES 3, 4; PLATE 84, FIGURE 3

1831. *Helix (Bulima) rufogaster* LESSON, Illustrations de zoologie, pl. 22.  
 1837. *Orthostylus rufogaster* BECK, Index molluscorum praesentis aevi musei principis Chr. Frederici, p. 49, no. 6.  
 1842. *Bulimus rufogaster* PFEIFFER, Symbolae, vol. 3, p. 85.  
 1846. *Bulimus rufogaster* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, 2d ed., vol. 1, Abth. 12, Theil 2, pp. 164-165, in part.  
 1848. *Bulimus rufogaster* PFEIFFER, Monographia heliceorum viventium, vol. 11, p. 6, in part.  
 1849. *Bulimus rufogaster* REEVE, Conchologia Iconica, species 4, in part.  
 1850. *Bulimus rufogaster* ALBERS, Die Heliceen, 1st ed., p. 135.  
 1851. *Bulimus rufogaster* DESHAYES, Ferussac's histoire naturelle mollusques, vol. 1, p. 9.  
 1853. *Bulimus rufogaster* PFEIFFER, Monographia heliceorum viventium, vol. 3, p. 295, in part.



1858. *Cochlostyla rufogaster* H. and A. ADAMS, Genera of recent Mollusca, vol. 2, p. 142.
1859. *Bulinus rufogaster* PFEIFFER, Monographia heliceorum viventium, vol. 4, p. 357.
1859. *Cochlostyla rufogaster* PFEIFFER, Monographia heliceorum viventium, vol. 4, p. 853.
1860. *Orthostyla rufogaster* MARTENS, Albers, Die Heliceen, 2d ed., p. 178.
1867. *Cochlostyla rufogaster* MARTENS, Die preussische Expedition nach Ost-Asien, vol. 2, p. 92, in part.
1868. *Bulinus rufogaster* PFEIFFER, Monographia heliceorum viventium, vol. 6, p. 6.
1868. *Cochlostyla rufogaster* PFEIFFER, Monographia heliceorum viventium, vol. 6, p. 596.
1874. *Cochlostyla rufogastra* SEMPER, Reisen im Archipel der Philippinen, pt. 2, vol. 3, p. 202, in part.
1876. *Bulinus rufogastra* PFEIFFER, Monographia heliceorum viventium, vol. 8, p. 6.
1876. *Cochlostyla rufogastra* PFEIFFER, Monographia heliceorum viventium, vol. 8, p. 682.
1883. *Cochlostyla rufogastra* PAETEL, Catalog der Conchylien-sammlung, 2d ed., p. 97.
1887. *Cochlostyla rufogaster* HIDALGO, Journ. Conchyl., vol. 35, pp. 160-161, in part.
1890. *Cochlostyla rufogaster* PILSBRY, Man. Conch., ser. 2, vol. 7, p. 207, in part, fig. 7.
1891. *Cochlostyla rufogaster monozona* HIDALGO, Obras Malacologicas, pp. 372-4, in part, pl. 61, fig. 3.
1894. *Helicostyla rufogastra* PILSBRY, Man. Conch., ser. 2, vol. 9, p. 227.
1896. *Orthostyla rufogaster* ELERA, Catalogo sistematico de toda la fauna Filipinas, p. 593, in part.
1898. *Cochlostyla rufogastra* MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 138, in part.
1912. *Cochlostyla rufogastra* MÖLLENDORFF, Kobelt and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pt. 14, pp. 286-7, pl. 61, figs. 1, 2, in part.

The only shell in our collection that resembles Lesson's figure (see pl. 83, figs. 3 and 4), is also a worn specimen that I collected at Mari-veles, Bataán Province, Luzon (pl. 84, fig. 3). The harbor of Mari-veles at the entrance to Manila Bay must have been visited often by sailing vessels in the days of old, and it seems quite possible that the shell described by Lesson from the collection of the Duke of Rivoli may have come from there, and I shall so consider it here. It is also possible that those cited by various authors as coming from Zambales belong here. In fact this seems more than probable, since the Zambales mountain range is faunistically quite distinct, being well separated from the mountains to the east by flat plains regions.

The typical race is elongate-ovate. The early whorls in the de-corticated shell are flesh colored, gradually tending toward rufous

on the base. There is a conspicuous broad light zone at the periphery, which is well rounded. The peristome is very dark brown.

The elongate, almost conic form, the large size, rounded periphery, and very dark peristome are its distinctive characters.

*Remarks.*—Lesson gives 3 pouces as the height of the shell, which is equivalent to 81.21 mm; its greater diameter is said to be 21 lignes (=47.38 mm), while the height of the aperture is 19 lignes (=42.86 mm); diameter of aperture, 14 lignes (=31.58 mm).

Our shell, U.S.N.M. No. 256076, has 6.1 whorls, and measures: Height, 74.6 mm; greater diameter, 51.5 mm; height of aperture, 41.4 mm; diameter of aperture, 29.6 mm.

**COCHLOSTYLA RUFOGASTER BANAHAOANA, new subspecies**

PLATE 85, FIGURE 4

1891. *Cochlostyla rufogaster* HIDALGO, Obras Malacologicas, p. 373, in part.

Shell broadly ovate with a decided angle at the periphery of the last whorl, which may or may not have a yellowish spiral band when denuded of its periostracum. The race is nearest to *Cochlostyla rufogaster montalbana*, but differs from it by having the periphery much more angulated. The interior of the aperture and peristome is also much darker.

*Specimens examined.*—The type, U.S.N.M. No. 255968, was collected by myself at Majayjay, Santa Cruz Province, Luzon. It has 6.1 whorls, and measures: Height, 73 mm; greater diameter, 52 mm. I have additional immature specimens from the same general region, which agree with the type as far as parallel growth and marking are concerned.

This may be the shell that Hidalgo reports from Lucban, a locality also in the Mount Banahao region.

**COCHLOSTYLA RUFOGASTER TOPPINGI, new subspecies**

PLATE 85, FIGURE 3

This is the giant race that occupies Mount Maquiling in Laguna Province, Luzon. It is very elongate-ovate in shape. The three specimens before us all lack the light peripheral zone when the periostracum is removed. The periphery is feebly angulated. The peristome is very dark chocolate-brown and the columella is axially streaked with brown. The interior is dark bluish pearly gray.

*Specimens examined.*—The type, U.S.N.M. No. 310514, was collected by LeRoy Topping at Mount Maquiling. It has 7 whorls, and measures: Height, 91.8 mm; greater diameter, 56 mm. Another specimen, U. S. N. M. No. 311334, from the same locality, collected



by Dr. C. F. Baker, also has 7 whorls, and measures: Height, 87.7 mm; greater diameter, 58.4 mm, while a third, U.S.N.M. No. 255864, from the same place, collected by myself, has 6.5 whorls, and measures: Height, 87.5 mm; greater diameter, 56.9 mm.

*Remarks.*—The huge size alone at once distinguishes this race from all the others.

#### COCHLOSTYLA RUFOGASTER, subspecies?

A number of immature specimens from localities not embraced specifically in the races here treated indicate by their distinct features that they require subspecific recognition, but this will have to await the arrival of more complete material than that at hand. Very distinct from the races treated seem to be some specimens from Pampanga Province, Sibul Springs, Bulacán Province, and Mount Polio, Banaue, Nueva Vizcaya, a locality unknown to me.

Then, too, the references of the early writers to *Cochlostyla rufogaster* from localities distant from those from which our material has come indicate further collecting and research in these places.

For example, Semper in 1874 in his *Reisen im Archipel der Philippinen*, reports the species from Baler, which is on the east coast in the northeast corner of Tayabas Province, Luzon, a long distance from any of the races that I recognize. This will undoubtedly prove distinct.

Hidalgo, in his *Obras Malacologicas* in 1891, reports in addition to many of the recognized races, specimens of *Cochlostyla rufogaster* from Dingalan, Tayabas; La Union (Camarines Sur ?), Pangasinán; Tarlac; Zambales; Morong, Rizal Province and Batangas, from none of which I have seen material. Those cited by him from northern Luzon under this name belong to a distinct species.

Von Möllendorff repeats citing the above in the *Abhandlungen der naturforschenden Gesellschaft zu Görlitz* in 1898, under the species.

It is to be hoped that these notes will call attention to the need of adequate material from the places mentioned, the securing of which will give us a better understanding of the range of the species and its races.

#### OBBA MARMORATA AND ITS RACES

A recent sending of a collection of land shells to the National Museum by the Philippine Bureau of Science for identification and report made it necessary to subject *Obba marmorata* to a critical review, with the result that some shifting of older names as usually conceived became necessary, and a number of new zoogeographic races required defining.

## OBBA MARMORATA (Von Möllendorff)

This mollusk was described by Von Möllendorff as a subspecies of *Obbina planulata* Lamarck. The large collections in the United States National Museum demonstrate plainly not only that it should be recognized as a distinct species but also that we must recognize a number of zoogeographic races, which are herein defined.

*Obba marmorata* varies in shape from broadly conic to depressed-helicoid. The last whorl is obscurely angulated at the periphery, and the last half of the turn has a second obscure angulation between this and the summit, the space between the two being somewhat flattened, while the whorl between the summit and first angulation is well rounded. The postnuclear whorls are marked by rather rough, irregular, and retractorily curved incremental lines, which in some of the races almost amount to ribs. In addition to these, the surface is marked by irregular and irregularly spaced impressed lines, which are more or less spiral in arrangement on the early turns, but which on the later whorls assume the form of oblique or zigzag wrinkles. The base is always well rounded and openly unbilicated, the umbilicus being partly closed by the reflected inner lip. The peristome is white, thickened, expanded, and reflected. A tooth is present near the middle of the basal lip.

The ground color is flesh color, in some with a yellowish tinge, marbled and variegated with brown. There is a tendency, or even a stronger expression in some races, to the formation of a peripheral, superperipheral, and basal spiral band.

The species ranges from Ilocos Sur south through Benguet, Pangasinan, Nueva Ecija, and Rizal Provinces, Luzon, and the smallest race of the species *Obba marmorata ilinensis*, new subspecies, comes from the little island Ilin south of Mindoro.

## KEY TO THE SUBSPECIES OF OBBA MARMORATA VON MÖLLENDORFF

- Periphery of last whorl with a decided angle.
- Greater diameter more than 31 mm..... bolinaoana
  - Greater diameter less than 18 mm..... benguetana
- Periphery of last whorl without a decided angle.
- Shell broadly conic.
    - Greater diameter more than 35 mm..... marmorata
    - Greater diameter less than 25 mm..... ecijana
  - Shell not broadly conic.
    - Shell depressed-helicoid.
      - Greater diameter more than 27 mm..... rizalana
      - Greater diameter less than 25 mm..... ilinensis



## OBBA MARMORATA BOLINAOANA, new subspecies

## PLATE 86, FIGURE 5

In this race the periphery of the last whorl is decidedly angulated, and the base is much less inflated than in the typical form. It resembles most nearly *Obba marmorata benguetana*, from which it differs by being larger and smoother, in having a larger umbilicus, a much stronger peristome, and a much larger aperture; it also has a much paler color pattern.

*Type*.—U. S. N. M. No. 116345 has 4.8 whorls, and measures: Height, 17.5 mm; greater diameter, 31.9 mm; lesser diameter, 24.3 mm. It was collected by Cuming at Bolinao, on the northwestern point of Pangasinan Province, Luzon.

## OBBA MARMORATA BENGUETANA, new subspecies

## PLATE 86, FIGURE 4

This is the smallest known race with the sharp angulation of the periphery and the poorly rounded base. It is much thinner and darker colored than *Obba marmorata bolinaoana*. Its umbilicus and the aperture are smaller, the peristome is much less strongly developed, and the under surface of the last whorl is ever so much more strongly wrinkled.

*Type*.—U.S.N.M. No. 256484 has 5 whorls, and measures: Height, 13.7 mm; greater diameter, 27.3 mm; lesser diameter, 21.8 mm. It was collected by Dr. E. A. Mearns at an altitude of 5,000 feet at Baguio, Benguet Province, Luzon.

*Additional material*.—Four topotypes, U.S.N.M. No. 256563, yield the following additional measurements:

| Number of whorls | Height             | Greater diameter   | Lesser diameter    |
|------------------|--------------------|--------------------|--------------------|
|                  | <i>Millimeters</i> | <i>Millimeters</i> | <i>Millimeters</i> |
| 5.1-----         | 13. 8              | 16. 2              | 11. 7              |
| 5.0-----         | 13. 9              | 17. 8              | 11. 9              |
| 5.0-----         | 14. 0              | 16. 8              | 12. 1              |
| 4.9-----         | 13. 5              | 15. 9              | 11. 0              |

## OBBA MARMORATA MARMORATA (Von Möllendorff)

## PLATE 86, FIGURE 6

1898. *Obbina planulata marmorata* VON MÖLLENDORFF, Abh. Naturf. Ges. Görlitz, vol. 22, p. 85.

1905. *Obbina planulata marmorata* VON MÖLLENDORFF, Kobelt and Winter, Semper's Reisen im Archipel der Philippinen, vol. 10, pt. 1, p. 20, pl. 5, fig. 3.

This is the large, comparatively pale, race that Von Möllendorff states (*loc. cit.*) comes from Ilocos Sur, Abra, Benguet, and Tiagan. I suspect that Benguet as given by him is really Bangued in Abra Province, which would make the distribution cited a compact and not a discontinuous one. Our shells from Benguet represent a much smaller race, upon which, had Von Möllendorff possessed specimens, he would not have hesitated to bestow a name.

*Specimens examined.*—The specimen figured, U.S.N.M. No. 312998, was collected by Quadras on Mount Bulagao, Ilocos Sur, Luzon. It has 4.5 whorls and measures: Height, 18.4 mm; greater diameter, 36.3 mm; lesser diameter, 27.5 mm. Two additional specimens, U.S.N.M. No. 116332, collected by Cuming in "Luzon," have each 4.2 whorls. They measure: Height, 19.5 and 20 mm; greater diameter, 34.9, 35.6, and lesser diameter, 28.2, 27.4 mm, respectively.

**OBBA MARMORATA ECIJANA, new subspecies**

PLATE 86, FIGURE 1

In this race the periphery of the last whorl is not strongly angulated, but appears as a slender thread. The base is rather inflated and well rounded. The shell is decidedly elevated and broadly conic. The aperture is large and broadly oval. The wrinkles are strongly developed both on the upper and basal surface. In size it approaches *Obba marmorata rizalana*, but it can be at once distinguished from that by its much more elevated spire and coarse wrinkled sculpture, which is almost obsolete in *Obba marmorata rizalana*.

*Type.*—U.S.N.M. No. 312996 has 5.1 whorls and measures: Height, 18.2 mm; greater diameter, 31.8 mm; lesser diameter, 24.7 mm. It was collected at Lupao, Nueva Ecija, Luzon.

*Additional material.*—Four topotypes, U.S.N.M. No. 312997, yield the following additional measurements:

| Number of whorls | Height             | Greater diameter   | Lesser diameter    |
|------------------|--------------------|--------------------|--------------------|
|                  | <i>Millimeters</i> | <i>Millimeters</i> | <i>Millimeters</i> |
| 5. 1.....        | 17. 5              | 31. 8              | 24. 8              |
| 5. 6.....        | 18. 8              | 29. 9              | 23. 2              |
| 5. 4.....        | 16. 7              | 29. 9              | 23. 2              |
| 5. 4.....        | 18. 4              | 31. 3              | 24. 4              |

**OBBA MARMORATA RIZALANA, new subspecies**

PLATE 86, FIGURE 2

This is a dark-colored race of depressed-helicoid shape. It belongs to the group in which the periphery is not conspicuously angulated



and in which the base is slightly inflated and well rounded. The incremental sculpture is almost riblike and decidedly retractorily curved on the last whorl, but the impressed wrinkles are only poorly shown. It can be at once distinguished from *Obba marmorata ecijana* by its being decidedly depressed, by having the aperture much smaller and much more narrowly oval, and by having the base almost free from wrinkles.

*Type*.—U.S.N.M. No. 312999 has 5 whorls, and measures: Height, 14 mm; greater diameter, 28.7 mm; lesser diameter, 22.2 mm. It was collected by F. Juan at Novaliches, Rizal Province, Luzon.

*Additional material*.—Thirteen topotypes are before me, six of which are U.S.N.M. No. 313000; the other seven will be returned to the Philippine Bureau of Science. These specimens yield the following measurements:

| Number of whorls | Height             | Greater diameter   | Lesser diameter    |
|------------------|--------------------|--------------------|--------------------|
|                  | <i>Millimeters</i> | <i>Millimeters</i> | <i>Millimeters</i> |
| 4. 7-----        | 13. 0              | 29. 0              | 22. 8              |
| 5. 0-----        | 14. 2              | 28. 2              | 21. 8              |
| 4. 8-----        | 13. 8              | 28. 2              | 22. 0              |
| 4. 9-----        | 14. 3              | 28. 0              | 22. 3              |
| 4. 8-----        | 13. 1              | 29. 1              | 22. 6              |
| 4. 8-----        | 13. 8              | 27. 3              | 21. 2              |
| 4. 8-----        | 13. 3              | 27. 4              | 21. 8              |
| 4. 8-----        | 13. 8              | 29. 1              | 22. 6              |
| 5. 0-----        | 14. 3              | 28. 9              | 22. 2              |
| 4. 8-----        | 13. 4              | 27. 5              | 21. 3              |
| 4. 9-----        | 14. 0              | 29. 2              | 22. 4              |
| 5. 0-----        | 14. 8              | 28. 5              | 22. 3              |
| 4. 8-----        | 14. 1              | 27. 3              | 21. 7              |

**OBBA MARMORATA ILINENSIS, new subspecies**

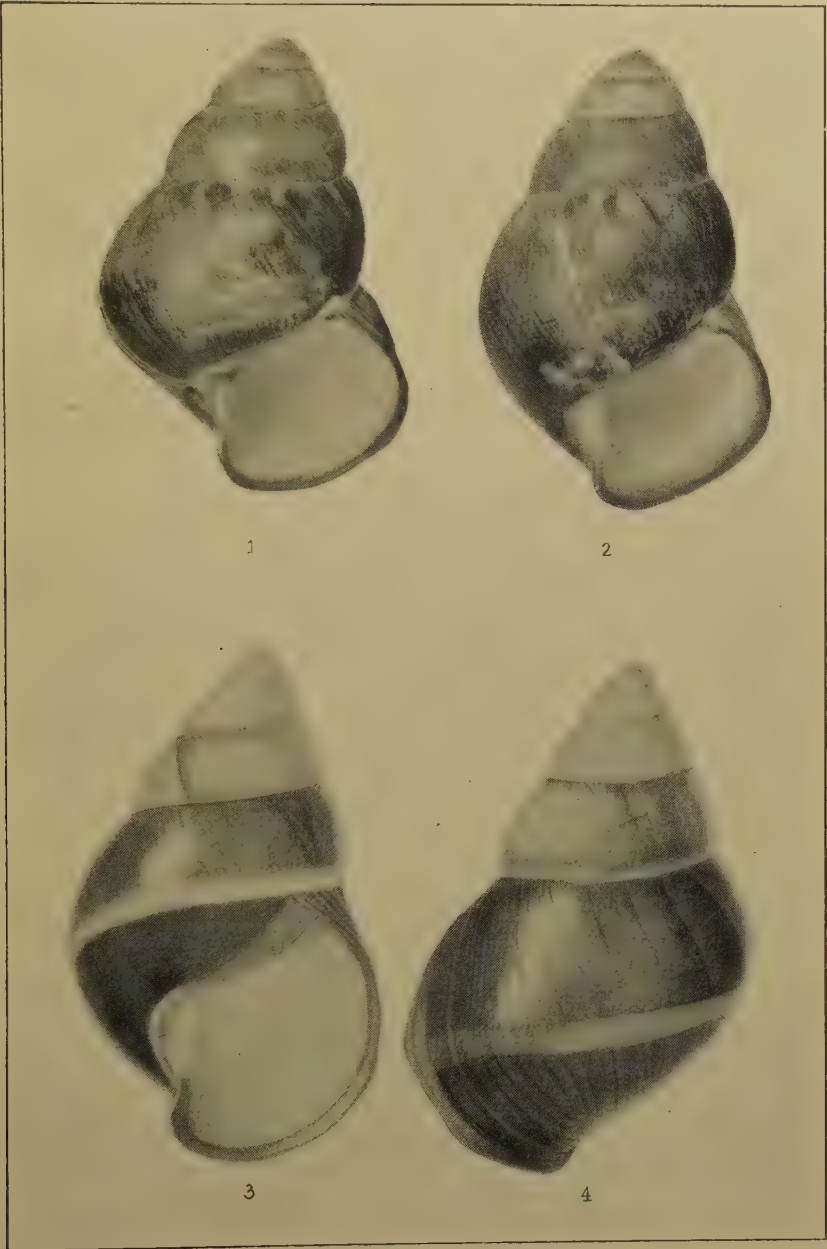
**PLATE 86, FIGURE 3**

This is the smallest race of this species. Its distribution is rather interesting, and it is quite possible that careful collection in Mindoro will show races of it eventually. It is a pale race, the shell being rather broadly conic. The periphery of the last whorl is rather rounded than angulated, but an obsolete indication of angulation is present. The incremental lines on the upper and lower surface are not so rough as in the other races, and the wrinkling of both surfaces resembles scratches more than the strong wrinkles of some of its other subspecies. The aperture is oval, and moderately broad, and the peristome is strongly expanded and reflected on the outer and basal lips. The umbilicus is narrow and half covered by the reflection of the inner lip.

*Type*.—The unique type, U.S.N.M. No. 313001, was donated by Walter F. Webb. It comes from Ilin Island, which lies a short distance off the south coast of Mindoro. It has 4.8 whorls, and measures: Height, 13 mm; greater diameter, 14.2 mm; lesser diameter, 19 mm.







RACES OF COCHLOSTYLA RUFOGASTER

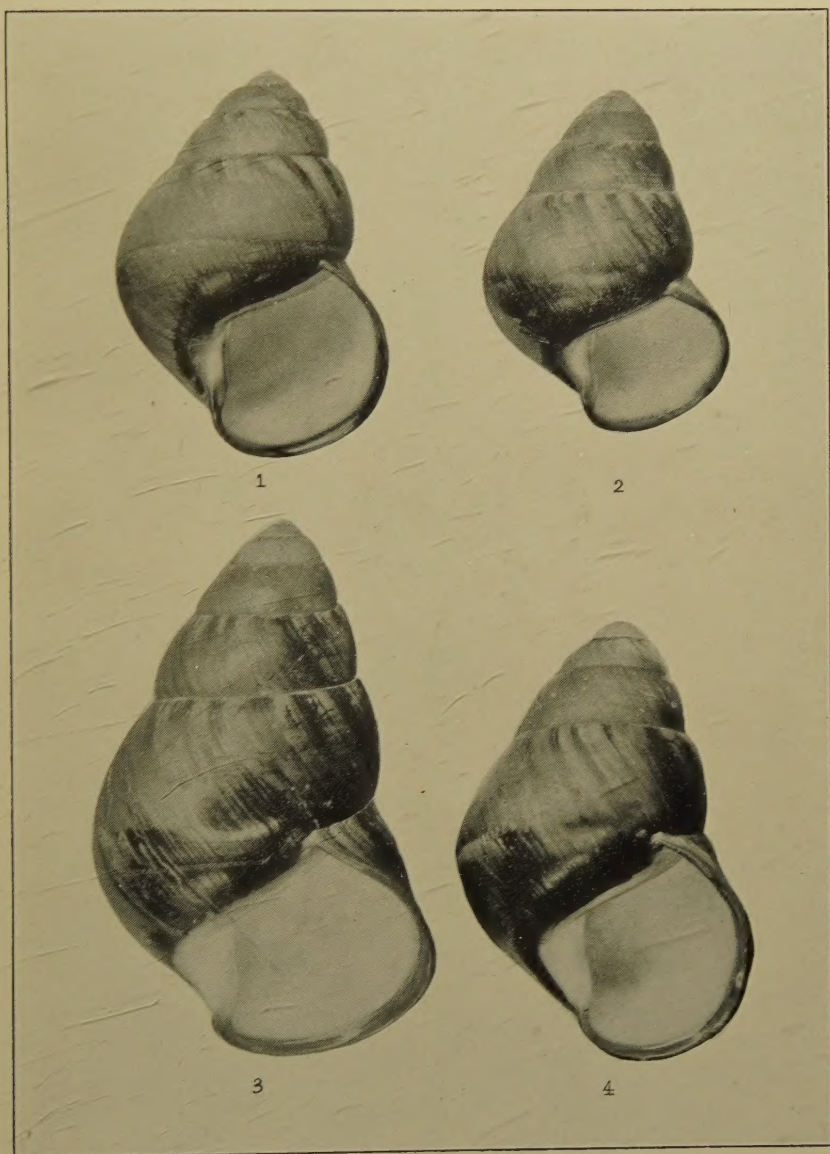
1, *Cochlostyla rufogaster montalbana*; 2, *C. r. benquetana*; 3, 4, *C. r. rufogaster*, copy of Lesson's figure. Slightly reduced.



RACES OF COCHLOSTYLA RUFOGASTER

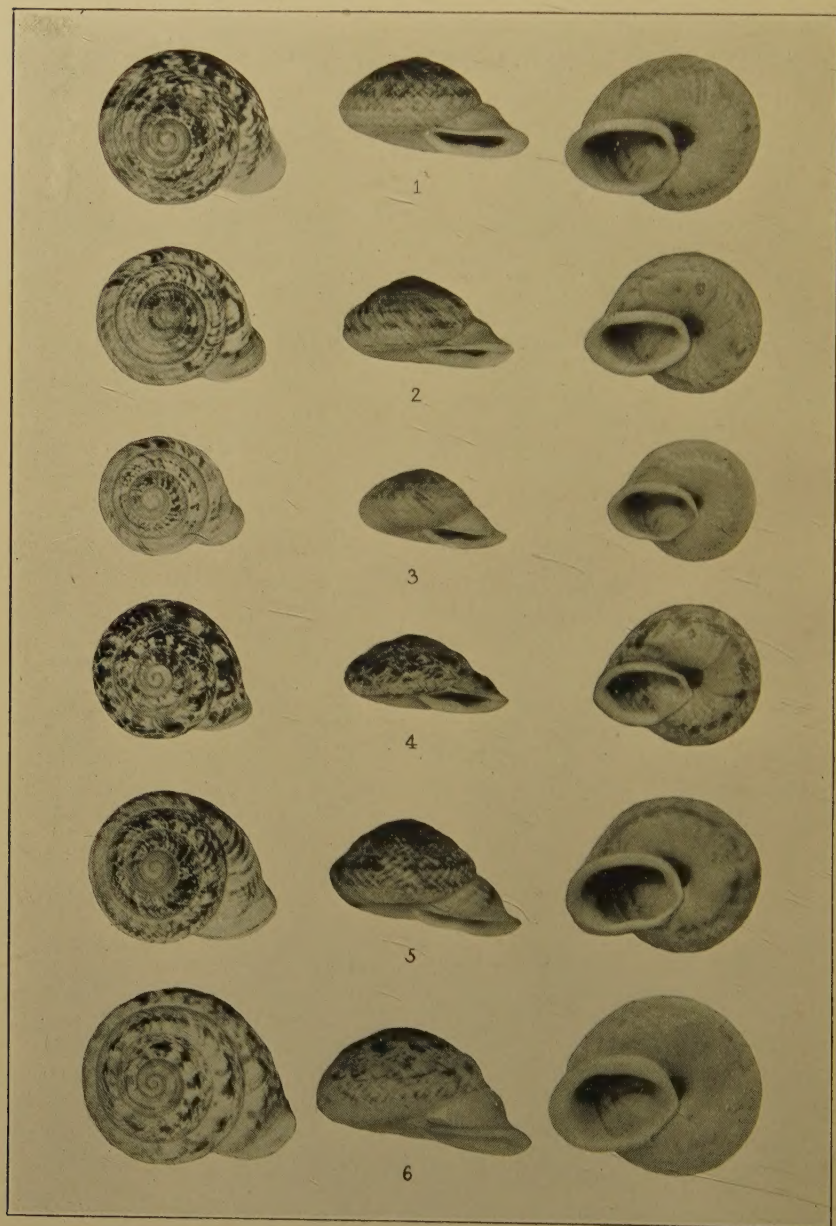
1. *Cochlostyla rufogaster monozona*, copy of Pfeiffer's figure; 2. *C. r. monozona*; 3. *C. r. rufogaster*; 4. *C. r. manilana*. Slightly reduced.





RACES OF COCHLOSTYLA RUFOGASTER

1, *Cochlostyla rufogaster juani*; 2, *C. r. antipolana*; 3, *C. r. toppingi*; 4, *C. r. banahacana*. Slightly reduced.



## OBBA MARMORATA AND ITS RACES

1, *Obba marmorata ecijana*; 2, *O. m. rizalana*; 3, *O. m. ilinensis*; 4, *O. m. benguetana*; 5, *O. m. bolinaoana*; 6, *O. m. marmorata*. Slightly reduced.







